6. *Conclusion*

We began this introduction by remarking that issues of convergence run through most of the papers, albeit in a largely implicit fashion. It is also worth noting that, while the papers address public policy issues, business strategy considerations underlie them. Although public policy will have critical effects on the attractiveness of entry and competition, it is private sector managers who will decide if and when entry takes place and what investments are made.

In several instances policy-makers have been disappointed when telecommunications firms failed to adopt business strategies that would propel the industry towards competition; in other cases strategies were devised that were not contemplated but brought added competition to these markets. For instance, the 1996 Act carefully structured terms and conditions on entry into local exchange markets to encourage interexchange carriers to enter and to pave the way for ILECs to participate in long-distance services. In fact, a virtual standoff has emerged in which all the major interexchange carriers have retreated from their efforts to enter the local exchange by scaling back investment (e.g. MCI), redirecting investment (e.g. Sprint's wireless strategy) or abandoning their plans (e.g. AT&T). At the same time an unanticipated response to the Act has been the formation by ILECs of competitive local exchange subsidiaries that would compete with other ILECs outside the parents' home regions and with the parent operations inside the regions.

Policy-making is most effective if regulators are able to anticipate if and how business leaders will exploit the business opportunities afforded them through regulatory change. However, regulators—and everyone else, for that matter—have limited abilities to predict which business strategies will be adopted. And by creating new competitive opportunities, convergence only increases the regulatory challenges. In the light of the limited foresight possessed by all of us, the best policies are those that are robust to surprises.

We expect the need for, and the form of, interconnection rate regulation and other types of government intervention to be hotly debated for years to come. The papers in this special issue provide numerous insights into this debate. We know that you will enjoy reading them.

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Prospects for Deregulation in Telecommunications

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The FCC and state regulators have been working hard since the 1996 passage of the Telecommunications Act to restructure regulation to make it more compatible with competition. Deregulation remains an especially complex problem for telecommunications, given such factors as its dependence on carrier-to-carrier cooperation, tendency toward a natural monopoly, the multi-dimensional aspects of competition, and the political constraints on deregulation. The paper suggests four organizing principles for deregulation: (A) accept some trade-off, given a state of competition; (B) recognize ex ante as well as ex post effects; (C) remove stepping stones if they become deadweight; and (D) evolve away from subsidy mentality. The paper suggests some steps toward exploring the implications and possible implementation of these principles.

1. *Overview*

The FCC and state regulators have been working hard since the 1996 passage of the Telecommunications Act (and before), restructuring regulation to make it more compatible with competition. Regulators have formulated policies for arbitration of interconnection between carriers if voluntary negotiations fail, with the goal of facilitating competition through allowing entrants to share incumbents' networks; they have moved towards restructuring the so-called universal service subsidies to make them more compatible with competition; and they have initiated 'access reform' and 'rebalancing' changes in how incumbents charge for their networks and services, in order to bring entry incentives more closely in line with efficiency. Yet these initiatives, while important steps towards the possibility of a de-regulated competitive

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environment in telecommunications, are not themselves deregulation. How and when, then, do we actually get to deregulate? This paper seeks to bring that difficult question closer to the top of everyone's agenda.

Unfortunately, the process of deregulation will be controversial, contentious and complex. Because telecommunications demands substantial carrier-to-carrier cooperation, and because there are strong forces that, in the absence of sharing and cooperation, would tend to create a natural monopoly, some forms of regulation promote rather than limit competition. Also, because the state of competition in telecommunications is so multi-dimensional, it will not be straightforward even in principle to tailor deregulation to the evolving state of competition. Finally, the history of regulation has created political constraints on deregulation. For these reasons, deregulating will be a complex problem. In this paper, which is meant as a modest contribution to that problem, I put forward for debate four potentially useful organizing principles:

A. *Given a state of competition, accept some trade-off.* Deregulation is likely justified even under quite imperfect competition. In assessing how imperfect, one should weigh any price or other market power inefficiencies that deregulation would allow against the likely benefits of deregulation, broadly considered. In this balancing, we should remember that deregulation may cause firms to improve efficiency in ways that are hard for anyone to imagine *ex ante*. Therefore (although this advice is inherently difficult to take), we should weigh the unspecified as well as the relatively predictable benefits. Although telecommunications is unique in many ways, I also think it is salutary to contemplate analogies from other industries, to avoid being overly influenced by the telecommunications-specific tradition of pervasive regulation.

B. *Recognize* ex ante *as well as* ex post *effects.* The overall balancing between problems of market power and problems of regulation should consider not only current competitive conditions (as in Principle A), but also the effects on the growth of competition of adopting a particular rule for when to deregulate. If deregulation will enhance incentives for desirable entry, then in order to get the greatest total benefits we may need to commit in advance to policies that will seem somewhat 'too deregulatory' in each instant application. Below, I will call the analysis in terms of current competitive conditions the *ex post* analysis, and the analysis of effects on the development of competition the *ex ante* analysis. In the

latter, one must consider both incentives of the incumbent and incentives of others.

C. *Remove stepping stones if they become deadweight.* While the early growth of competition can be greatly enhanced by the rights of entrants to share the incumbent's network at cost-based prices, this may not prove a satisfactory solution in the long run (in particular, it demands continuing regulation of such unbundling). Therefore we should develop policies for deregulating this sharing too, if and when it becomes appropriate. In assessing such policies, and in judging when the time is ripe, our views will be colored by which of two appealing interpretations of regulated sharing we adopt: should regulated sharing be seen as an acceptable long-term solution or only as a stepping stone to facilities-based competition?

D. *Evolve away from subsidy mentality.* Despite progress towards reform of 'universal service' subsidies, one serious barrier to deregulation will be the culture of entitlement to broad subsidies that encrusts telecommunications policy. It will therefore be crucial to reduce the scope of that culture and those subsidies. One likely strategy may be to start by deregulating 'new' services, to wall them off from the culture of entitlement. As in Principle B, proper consideration of long-run effects may imply a rule that would seem too deregulatory when examined narrowly in any particular application.

I stress again that these 'principles' are tentative, and I mean them to provoke discussion rather than to be enshrined. Below are some steps towards exploring their implications and possible implementation.

2. *Accepting Some Trade-off: Balancing Deregulatory Gains and Increased Market Power (Principle A)*

Why is deregulation desirable? If regulation helps keep prices close to cost, and stops users being gouged by firms with market power, is that not good? Does that mean that deregulation should just be a matter of 'delete needless rules'—eliminating regulations that are redundant because competition is a tighter constraint, or about as tight a constraint, on price gouging?

I think that would be too cautious a way to approach the problem. Typically, we should be prepared to deregulate even where we expect some adverse short-run (indeed, even long-run) price impact. Of course, this is a matter of degree and judgement, but we should keep in mind that even 'successful' regulation that holds prices nearer costs than would result from

deregulation likely has other, undesirable consequences. Thus, retaining regulation until it has no benefits at all means regulating too long.[1]

This deserves some explication, because economists have long been urging regulators to bring prices closer to costs. Am I saying this is unimportant? Not at all. If we assume that prices are to be regulated, the economic arguments for bringing prices close to costs are important (although certainly paying very close attention to cost incentives as well as price/cost comparisons). But economists' other message to regulators, which should often be more important if the two conflict, is that we should encourage competition, even quite imperfect competition, and allow market forces to work even if the result in the short term is prices considerably different from costs. Unregulated competition is typically better than regulation in many ways that go beyond the overall level of prices.

It is worth mentioning some of these ways, because if deregulation would let prices rise somewhat, we must balance the bad effects of such a price rise (bad, that is, if price does not start out below the efficient level!) against the good effects of deregulation. I will not attempt a complete list, but here are a few to keep in mind.

Unregulated competition does subtler things on prices than bring price levels to cost in the long run. It allows firms to cover common costs in creative and flexible ways. More generally, it lets firms experiment to find how customers prefer to pay the costs they incur.[2] And it lets prices—both as consumption signals and as investment signals—move at least somewhat in tandem with the first-best ideal, which, to oversimplify somewhat, is *short-run* marginal cost when there is plenty of capacity and *capacity-filling* price, perhaps well above cost (long-run or short-run), when there is not.[3] This is much subtler pricing behavior than 'keep prices near long-run cost' and would likely be very hard for regulators to implement, as it may demand a lot of information and would be very much subject to manipulation.[4] Although the two coincide in long-run equilibrium, transitory differences are

[1] Of course, this does not and cannot mean that whatever the right criterion for deregulation we should deregulate if we are 'close to' satisfying that criterion.

[2] Regulators can use economic principles to predict what pricing structures should be efficient, but in the end efficiency should be measured by what customers actually want, not what we predict they will want. Moreover, regulators do not always follow such recommendations about efficient pricing.

[3] More precisely, suppose that short-run marginal cost is c up to some capacity K, and production beyond K is (in the short run) impossible; suppose also that the demand price at capacity K is d. Then short-run economic efficiency requires that the price be $\max[c,d]$. (Peak-load pricing is an example of this kind of pricing.)

[4] Implementing this rule in every short run would, for instance, create strong incentives for a regulated monopolist to underinvest in capacity so as to get the higher capacity-filling price (d) rather than the low short-run marginal cost price (c). Those incentives diminish greatly as competition develops, however.

likely to be important in industries in which investment and capacity costs are important, investment is lumpy and demand is somewhat unpredictable; telecommunications probably fits into this category. Put another way, the pattern of high and low prices over time and as a function of capacity and demand may be just as important as the overall level of prices. Pricing at long-run cost *pays for* investment, but does not give the sharp signals 'invest all-out in capacity' or 'do not invest in capacity', with their high-powered incentives, that the unregulated market can give. While those signals are distorted if the market is imperfectly competitive, it seems very plausible that they are less distorted than under typical regulation. We should both recognize this effect and study its importance.

- Incentives to minimize costs are surely stronger under price caps and other 'incentive regulation' than under old-fashioned cost-based regulation, but even price caps without explicit sharing do not replicate the very high-powered incentives that face an unregulated firm—potentially an unlimited upside and a downside limited only by bankruptcy. Moreover, real-world incentive regulation may create problems of quality choice or of non-price discrimination that are absent or much less severe under unregulated competition.[5]
- Both by improving incentives and by removing administrative/legal hurdles, unregulated competition (and likely even unregulated monopoly) encourages more rapid innovation. Regulated firms have relatively little incentive to innovate if they doubt they will be allowed to keep the possible large rewards of successful innovation. Although this incentive problem can be mitigated if regulated firms can treat development expenses as cost, the resulting incentives are at best diluted. The long delays in introducing cellular service are a painful reminder of the hurdles and need to await approval created even by well-meaning regulation.
- Regulation has non-trivial direct costs. The smart and highly paid lobbyists, and the smart and underpaid regulators, could do something else, and legislators could turn their attention to our society's serious problems rather than argue about who will or will not pay a few dollars more or less a month.

With that encomium for deregulated competition, let me raise a natural big question: why not go all the way now?

[5] See e.g. Beil *et al.* (1995). I do not suggest that non-price problems are absent in imperfect competition, of course.

An Immediate Deregulatory Option

For the most part, the arguments below suggest a relatively gradual path to deregulation. But some would argue that we should instead deregulate everything except call termination, accept that some prices would almost certainly rise dramatically as the regulated local near-monopolists become unregulated local near-monopolists, and watch facilities-based competitors build out as fast as they can, to try to get in on the big profits before they are competed away, and in the process, of course, compete them away.

There is a certain appeal to this picture, perhaps especially for economists. I think this appeal to economists is only partly because they are more alert to the benefits of deregulation; it is also partly because they by and large are fairly prosperous. Less prosperous people, and those less committed to the merits of deregulation, might take a less philosophical attitude to a short-run doubling of their phone bills, even if it speeds innovation and reduces costs and prices in the longer run. And, whatever the true merits, it seems unlikely that the political process would let this happen. I therefore suspect that full-scale deregulation now is not an option.

Moreover, the argument as stated forgets the very important fact that the right to share the incumbent's network facilitates even a primarily bypass-oriented entry strategy: more on this below under Principle C.

However, we should keep this drastic approach in mind, because at some point the time will be ripe, and we should then be ready. Moreover, if we keep the drastic option in mind then we are closer to making the default be deregulation, in marked contrast to the world of telecommunications we know.

3. Ex ante *and* Ex post *Effects: Incentives for Facilities-based Entry (Principle B)*

As urged in Principle B above, we should not only consider whether deregulation makes sense based on existing competitive conditions (*ex post* analysis), but also how the prospect of deregulation in certain conditions will affect the growth of competition. For example, one element of the argument sketched above for immediate deregulation is the resulting strong incentive for facilities-based entry. A natural question is whether this incentive can be achieved equally well but with less (economic and political) damage from market power meanwhile, if deregulation follows rather than precedes facilities-based competition.

In general, economists start with the idea that incentives for entry depend

on entrants' expectations of incumbents' *post-entry* prices, not (directly) on what happens before entry. This would suggest that *pre-entry* regulation of the incumbent would not affect entry incentives. It also suggests that the prospect of price decreases following entry will reduce entry incentives—as indeed it generally will for entrants concerned primarily with profits in the market entered.

This view is somewhat oversimplified, however.[6] In particular, it ignores the possibility—probably important in telecommunications—that entrants may be customers who enter partly so as to escape an incumbent's high pre-entry prices. Similarly, suppliers of complements might enter so that their customers can escape such prices (and thus demand for the entrant's primary product rises).

In the case of entry into local telecommunications bottlenecks, this possibility would encompass long-distance companies, who are local exchange company customers in access services (or, one can equally say, provide services that are complements to local access). In addition, if (as many industry commentators believe) the industry will be driven by the wish for 'one-stop shopping', then suppliers of other goods such as multichannel video may come to see themselves as suppliers of complements to basic telephone connection.

Accordingly, it seems worth sketching the bare bones of an economic model in which to discuss the effect of pre-entry and post-entry pricing by the incumbent on entry incentives for entrants who are and who are not buyers. What follows is very preliminary and reflects my (surprised) inability to find such a discussion in the literature; if there is one, I would welcome learning of it (and apologize to its author).

Denote the incumbent's pre-entry price by p_0 and its post-entry price by p_1. The post-entry price p_1 could be higher than the pre-entry price p_0 if, for instance, the incumbent is deregulated upon entry but retains significant market power. Alternatively, p_1 could be lower than p_0 if, for instance, the incumbent chooses, and is permitted, to cut prices in response to competition, or if entry proves to regulators that the incumbent has been overcharging.

Consider the problem facing an entrant who believes that if it decides not to enter, no other firm will enter instead (so the pre-entry status quo will persist).[7] If it enters, it will get net profits Π in its operation as competitor to

[6] The academic literature on 'limit pricing' explores a number of ways in which this argument is oversimplified.

[7] Obviously this assumption will seldom apply literally, but a potential entrant certainly might believe that if it holds back, no other firm will enter immediately. In any case, this problem is an important analytical part of the more general problem.

the incumbent; this quantity will depend, presumably positively, on p_1. If it is also a buyer of, or a supplier of complements for, the incumbent's product, then its entry will also change the benefits V that it gets in that role, by changing the prices available to it as (say) buyer from p_0 to some price-index that incorporates p_1 and the entrant's own cost.[8] Thus, in general (including the case of a non-buyer by the device of treating it as having a constant V function), the net pay-off to entry would be

$$\Pi(p_1) + V(p_1,c) - V(p_0,\infty)$$

In other words, the pay-off from entry is the sum of Π and a change in V. As noted above, we would expect Π to increase in p_1 and V to decrease in both arguments. We can then note the following points towards an analysis of the entry-incentive effects of a policy of deregulation upon entry.

1. *If incumbent would raise price following entry and deregulation.* In this case (the case in which maximum-price regulation would continue to bind), the *ex ante* effect of a policy of deregulation following entry is to strengthen entry incentives for a non-buyer, because only Π matters. For a buyer (or supplier of complements), the prospect of deregulation following entry strengthens entry incentives if the (encouraging) effect of the higher p_1 on Π exceeds its (discouraging) effect on the change in V. This is more likely if, for instance, (i) the entrant will gain a large market share as a competitor to the incumbent but takes only a small fraction of output in its role as buyer; or (ii) once self-supply is possible, the entrant no longer much cares (as buyer) about the incumbent's price, or its preferences even reverse so that it prefers the incumbent to have a higher price. A particular case of (ii) may be if the entrant buys from the incumbent an essential input that is also bought by the entrant's competitors, in which case of course once it can (wholly or largely) self-supply, it would like p_1 to be high.[9]

[8] This formulation may seem strange to some readers: why would not an entrant simply supply itself at its cost? One answer has to do with limited capacity: whether in the conventional sense or in terms of end-users served, a limited-scale entrant might not be able to supply all its own needs, so it would care about the incumbent's price response. Another answer would apply more obviously to a supplier of complements: assuming the entrant does not supply the whole market at cost, the demand for complements (such as long-distance service if we are discussing entry into local access markets) would depend on some blend of prices in the market entered. Finally, to the extent that a buyer or supplier of complements competes against other buyers or suppliers of complements, it will care about prices offered (e.g. by the incumbent) to those rivals as well as about the price it pays itself.

[9] Thus it is widely recognized that competitive access providers, if not integrated into mass-market long distance, benefit from high access charges by ILECs.

2. *If incumbent would lower price following entry and deregulation.* In this case (the case in which maximum-price regulation would typically not continue to bind, but minimum-price regulation might), the *ex ante* effect of a policy of deregulation following entry is to weaken entry incentives for a non-buyer, because again only Π matters, and the reward Π from entry is lower because of the lower price p_1 from the incumbent. For a buyer (or supplier of complements), the prospect of deregulation following entry strengthens entry incentives if the (encouraging) effect of the lower p_1 on the change in V exceeds its (discouraging) effect on Π. This is more likely to happen if the entry contemplated is on a smaller scale than the entrant's stake as a buyer, and if the lower p_1 affects the buyer but not (or not *pari passu*) the buyer's competitors.

Thus, while it is somewhat ambiguous for some of the most likely potential entrants, it may well be that the *ex ante* effects of deregulation are to encourage entry. This would mean that if regulators can commit strongly and publicly to prompt (partial or full) deregulation in response to the arrival of competition, even at the risk of some increase in the incumbent's prices, then incentives for such entry may be much enhanced. So would be incentives for incumbents to refrain from trying to block entry.

Implementation

Making and keeping any commitment to deregulate in response to competitive entry will be difficult in practice, not least because 'the arrival of competition' is unlikely to be a sharply defined event. Rather, competitive conditions will improve gradually and at different speeds in different places and for different kinds of customer. We should perhaps therefore implement deregulation too on a highly disaggregated basis.[10] The discussion above also may be overly optimistic about how promptly deregulation would in fact occur after competitive entry, given the complexity of even the *ex post* problem. On the other hand, there has been discussion of reducing the pace of regulatory price reductions in response to developing competition (see e.g. Chong, 1997).

[10] In particular, the provisions of Sections 271–272 of Communications Act basing BOC entry into the interLATA market on statewide conditions may be too coarse-grained for ideal competition policy. This might be justified by arguing that finer-grained measures of competitive conditions could be taken into account, to the extent appropriate, through the Justice Department's input or the FCC's public interest investigation.

4. *Deregulatory Benefits of Entrants' Rights to Share Incumbent's Network; and Deregulating Those Rights (Principle C)*

In this section I very briefly explore two large and important topics. First, what are the competitive and deregulatory benefits of such sharing rights? And second, when and how should we deregulate such sharing? Clearly there is a tension between these two discussions. I describe two views of the role of regulated sharing, one that stresses its benefits and another that stresses its eventual withdrawal (deregulation of sharing).

Competitive and Deregulatory Benefits of Mandated Network Sharing

There are two appealing interpretations of the point of regulatory sharing provisions, and which interpretation one favors will color one's views of deregulatory proposals. Perhaps the two are best described by starting from the observation that competition requires that the incumbent's bottleneck facilities be *bypassed* or *shared*. Sharing requirements can help with this in two ways: obviously by conferring a right to share those facilities, and less obviously by potentially providing a stepping stone towards bypass.

In the first interpretation, regulation should strive to facilitate competition that involves efficient sharing by competitors of any or all parts of the incumbent's network, because there is no point bypassing the bottleneck if it can more efficiently be shared. In this interpretation, it is quite possible and acceptable if (for some parts of the network, in some areas) there is never bypass: it will prove that sharing works well, and save society the very large costs of bypass.

Any bypass, in this first interpretation, should be driven not by the need to bypass merely in order to compete, but by the need to bypass in order to do things that sharing cannot or will not do. Thus bypass will be driven by the urge to innovate in ways that the incumbent's network cannot allow, and by the inefficiencies of regulated sharing, such as provisioning problems that regulators cannot cure, overpricing, underpricing if it makes the incumbent's network fall behind the technological frontier, or by the non-incumbents' reluctance (notwithstanding regulatory protection) to rely on a competitor.

In its strong form, this first interpretation is agnostic on whether bypass or sharing, or a mixture of the two, is the desirable end result; it aims to let 'the market' decide (element by element and area by area) between unregulated bypass and regulated sharing. Moreover, to the extent that bypass will be the

solution in the long run, it lets the market decide *when*, without meanwhile closing off all competition. In particular, it might be highly inefficient for competitors to overbuild now if the costs of overbuilding are falling very rapidly. (Some have suggested that this is the case in cable telephony or in fixed-wireless local loop service.) In this perspective, if competitors delay build-out and instead share the incumbent's facilities at least for a while, that is perfectly fine.

In the second interpretation, sharing is not a solution but a stepping stone, because only bypass will enable (more or less) full deregulation. In this view, the rationale of the sharing rules is that bypass might never happen, or might be slower to arrive, if it had to happen all at once, so sharing is encouraged as a transition or as a fill-in to facilities-based competition or bypass. This interpretation rests on a grand judgement that bypass and (substantially more) deregulation, not sharing, is the desirable end result. In this view, sharing that lowers the barriers to eventual bypass is good but sharing that discourages bypass is bad, because only bypass can bring true deregulation.[11]

This second interpretation is a more radical departure from the old 'natural monopoly' theory, which supposed that bypass was generally undesirable. And, of course, since bypass will indeed permit much more deregulation than sharing, it may seem more appealing to those who think regulation is most inefficient. But this reaction is too simple, in that the more inefficient is regulation, the stronger the incentives to bypass even when regulation does all it can to facilitate sharing. The argument that this sharing might postpone or prevent full bypass and the fullest possible deregulation is met, in the first of our two views, by noting that if regulated sharing is inefficient then in the long run competitors will not want (or be able) to rely on it.

Perhaps we should not irrevocably choose between these two interpretations *a priori*, but rather should watch how competition with regulated sharing evolves. Predictions certainly differ widely at present. Optimists hope that effective regulated sharing of the incumbent's network will permit vigorous competition in services without inefficient infrastructure bypass. They also hope that it will form a crucial stepping stone and complement to efficient bypass. Pessimists fear that network sharing will tame competition

[11] Even proponents of this interpretation tend to accept the mainstream view that call termination should be regulated. Termination is a form of network sharing and, just as one would expect from that fact, it seems that in the absence of regulated termination there would be more gross incentive (though probably much higher barriers) to building a completely duplicative network and thus being able to terminate calls to all customers. The 'stepping stone' view is therefore perhaps not quite as conceptually clean as it may appear. But I do not mean to minimize the large difference between (eventually) regulating only call termination and (permanently) regulating call termination plus provision of network elements, etc.

through an incumbent firm's discretionary gift of unenforceable cooperation,[12] and will produce inefficient rent-seeking by entrants more interested in getting underpriced leases than in efficient competition. The worst outcome may be the one in which regulatory uncertainty persists, so that potential entrants never quite get the ability to share the incumbent's infrastructure but constantly hope to be able to, and so do not build.

Laissez-faire access reform: retail deregulation based on wholesale regulation. Besides the effects on the development of facilities-based competition, an important benefit from unbundled-element or platform competition is the possibility of what I call 'laissez-faire access reform': retail deregulation based on removal of obstacles to entry through sharing of the incumbent's network.

Ex post *analysis.* Smoothly functioning wholesale regulation permits, and indeed almost demands, retail deregulation.[13] If multiple providers can compete for a customer's business and promptly supply it at a reasonable overall cost, even if they do so by leasing the incumbent's facilities, then it would seem that prompt deregulation of all charges to the provider's end-user will be appropriate. If a carrier tries to charge too much overall to the end-user then another carrier will undercut, and by hypothesis this can happen quickly. If a carrier tries to charge a reasonable amount overall but in an inefficient manner, as, for instance, by undercharging for line rental (connection) and overcharging for usage, then (because that pricing system presumptively creates inefficiencies) another carrier can offer a more profitable alternative pricing package that is also better for the end-user. But it is important to note a major difference between this and the conventional economic advice to 'rebalance' rates: although economists can give good advice on what pricing schemes are relatively efficient and what schemes are not, the more robust lesson of economics is that of consumer sovereignty. That is, at least as competition develops, it should not be up to regulators to choose how end-users pay the cost of service—how much in flat charges, how much in usage charges, how much for special features, etc.

Implementation. If regulators continue to regulate the incumbent's retail

[12] This fear would provide one possible reason for continuing regulation, in that regulated cooperation is less susceptible to being withdrawn from a maverick competitor.

[13] By this I mean high-capacity, smoothly functioning arrangements for sharing the incumbent's network, including the so-called platform, at cost-based prices defined without reference to retail prices. Less full forms of this, such as flexible unbundling but without the platform, may or may not justify retail deregulation. Service resale of course does not in itself help here, since the prices paid by non-incumbents are based on the incumbent's retail prices.

prices and do not replicate the solution that the incumbent and the customer jointly find most beneficial, it puts the incumbent at an artificial competitive disadvantage. Thus, while there are obvious risks in premature deregulation of incumbents, there are also risks in waiting too long. Getting the timing right will not be easy for regulators. It would be surprising if the information flow and the organizational structures of regulatory agencies were optimized for this kind of challenge. Another major problem will be that, in general, provisioning of the platform or network elements will not go suddenly from 'slow' to 'immediate', so there may be an intermediate period in which either or both of the risks from wrong timing will be inevitable.

Another important implementation question will be the extent to which charges to competitors, as distinct from end-user charges, can be deregulated based on effective network sharing. This depends largely on the extent to which a carrier's charges to competitors are effectively passed through to its customers. That is a complex topic, affected by industry marketing traditions and by rules such as Section 254(g) of Communications Act, as well as by the distinction between originating and terminating charges, and possibly differing between incumbents and non-incumbents. (On the latter point, see FCC Report and Order 97-158, paragraphs 358–364.)

Whatever the details of the treatment of access, etc., the broad picture remains that retail prices could be deregulated in reliance on wholesale regulation. How valuable is this form of (semi-)deregulation? I do not think we know yet, but obviously it has its limits because it relies heavily on regulation of the prices and provisioning of 'wholesale' elements. When might we reasonably abandon it and deregulate the wholesale aspects of the incumbent's business?

Sharing and Wholesale Deregulation: Two Possible Triggers

Although allowing regulated sharing of the incumbent's network has a variety of good properties, it is not without problems and will demand continuing regulation. We should therefore think hard about when and how we can deregulate such sharing.[14]

[14] Section 10 of the Communications Act, as amended, authorizes the FCC to forbear from applying statutory provisions in light of competitive conditions, but this does not apply to Section 251 'until fully implemented'. However, Section 251(d)(2) tells the Commission, in choosing what network elements should be unbundled, to consider, at a minimum, whether unbundled access to 'proprietary' network elements is 'necessary,' and whether failure to 'provide access' would impair competitors' ability to provide service. Thus there seems to be at least some legal scope to consider the competitive implications of requiring or not requiring unbundling.

Obviously this too is a huge topic. I will limit myself to brief discussions of two possible deregulatory triggers, or situations that might suggest deregulation of the sharing of an incumbent's facilities: bypass by a competitor and bypass or upgrade/overbuild by the incumbent itself.

Bypass by a competitor. Suppose a competitor bypasses, say, the incumbent's loop to a subscriber. Then that element is no longer a true bottleneck: there is an alternative way to get calls the last mile to and from the customer. Should this trigger deregulation of sharing of the incumbent's loop?

Ex post *competitive analysis* (that is, once bypass is achieved). Such an analysis would include contemplation of the following:

- There is now a second firm that can compete to serve the customer without leasing the incumbent's loop. Thus, even if leasing does not work at all without regulation, competition (even rapid competition) is not entirely foreclosed.
- A third firm that needs a leased loop can plausibly get one without being wholly at the mercy of an incumbent monopolist. It has two possible sources from which to lease a loop.
- If the customer can be served using only one loop, then one of the two firms with loops likely has an *idle* loop to the customer, so a third firm might well be able to get a good price on a lease.[15]
- The fact that bypass has occurred is some evidence that further bypass would be possible, so it is less likely that the third firm would somehow be subtly blocked (for instance through control of rights of way) from doing its own bypass.

Ex ante *competitive analysis*. As indicated above in Principle B, it seems useful to focus separately on incentive effects for the incumbent and for others.

Incumbent's incentives: deregulation following bypass would reward the incumbent for cooperating (for instance, in rights of way, in co-location or in number portability) with bypass. This is clearly good under the pro-bypass interpretation of the Telecommunications Act. It has good aspects under the sharing interpretation too, although this is a little less clear, since in some cases it might also give the incumbent incentives to 'encourage bypass' by hampering sharing.

Non-incumbents' incentives: I note two points here. First, as discussed above,

[15] It is worth noting, though, that the entrant would be unlikely to build if it thought that it would end up leasing to a third party at below long-run cost.

an entrant may well have stronger incentives to bypass when it knows that, should it do so, the incumbent will no longer have to lease its loop at a regulated rate. Second, with multiple (potential) entrants the rule might even create something of a race to bypass, since building a third loop will presumably be less attractive. This racing seems good if we want to drive prompt bypass; it is less clear how to evaluate it if we want to preserve efficient sharing but also efficient (and efficiently timed) bypass.

Implementation issues: naturally, implementation of any such policy contains a host of challenges; I mention just four.

- Does wireless bypass count? Congress apparently thought not yet in February 1996 (it instructed regulators to regulate sharing if voluntary negotiations fail), perhaps because wireless prices (and quality) were still not competitive with wireline. But then how much must wireless capacity, quality and/or prices change before it should count? Applying Principle A, we should not wait until prices and quality reach full parity with wireline.
- Does the presence of coaxial cable that potentially can be, but for the most part currently is not, used for telephone service, count? Applying Principle B, we ought to be willing to say it does if we confidently conclude that deregulation of the incumbent would induce cable companies to enter promptly with a cable-telephony service and stop prices rising 'too much'. (Obviously, there would be timing and scope questions to resolve here, as well as questions of how large an interim price increase we would be willing to accept.)
- How should our answers depend on the duopoly behavior we observe in such cases?[16]
- For the *ex ante* incentive effects to work at full strength, deregulation would have to come promptly upon bypass, raising the same timing questions mentioned earlier.

Again, much depends on our balance between the two views of the Communications Act's share-the-network provisions. If we aim to make sharing work as well as possible, we should be concerned that (third-firm) entrants be able to share an existing network at cost-based prices even in the long term. If, on the other hand, we view interim sharing primarily as a stepping stone to aid the gradual development of facilities-based competition

[16] In the long-distance industry, capacity is voluntarily leased to some resellers at prices that are probably fairly near competitive levels, but there are more than two facilities-based carriers: 'BellSouth said it will wind up paying "at the low end" of one cent to two cents per minute to resell AT&T's service' (*Wall Street Journal*, 1996).

and deregulation, this may be a wise place to deregulate, for two intertwined reasons: deregulation makes considerable sense once there is bypass; and such a policy likely encourages bypass.[17]

Bypass (overbuild) and divestiture by the incumbent. My second potential trigger for deregulation is a kind of bypass/upgrade by the incumbent. I have in mind, for instance, the case where the incumbent builds new high-capacity loops to some of its subscribers, leaving the old copper in place (and in good shape); or where it installs a new switch and leaves the old one 'co-located'.

One can draw fairly close analogies between advantages of incumbency that are traditionally viewed as sources of 'natural monopoly' on the one hand, and intellectual property on the other (e.g. Farrell, 1996). The interconnection provisions of the Communications Act require incumbents to share those advantages, just as intellectual property policy requires patent-holders to share their intellectual property after the patent's term expires. And, just as in intellectual property policy, this sharing is only part of the right policy: reward to investment must also be given great weight. This perspective suggests that when an incumbent creates a 'new' network element, perhaps the new one need not immediately be made available on regulated terms, provided the old one remains available to non-incumbents.

Ex post *competitive analysis*. If the improvement is relatively modest, so that the old element serves at least the stepping stone purposes of the network-sharing policies, then the *ex post* arguments for making the new element also available to competitors are considerably weaker. However, this case may be rare (why would an incumbent build a modest improvement?). If the improvement is important enough, and if there are (in the absence of regulation of sharing) important natural-monopoly characteristics, such as strong network effects and/or economies of scope, then deregulation of sharing in the new sector might re-create the bottleneck market power that today's competition policy in telecommunications works so hard to avoid. Potentially, if the improvement were great enough, the availability of the old

[17] I note, however, that my analysis assumes that the incumbent's loop is a substitute for the entrant's. This seems likely if they are indeed loops to the same customer (although there certainly are counterexamples involving demand for multiple lines with one-stop shopping). The presumption would be much less clear if deregulation were to apply to 'nearby' lines (on the grounds of administrative simplicity and/or on the argument that bypass to subscriber A makes it seem that bypass to nearby subscriber B would be possible and might be imminent—both of which, by the way, could be good arguments for extending the deregulation in that way). Then, the incumbent's loop to subscriber B might well be a *complement* to the entrant's loop to subscriber A in the entrant's competitive strategy, and the analysis would be different.

element would be only a very weak competitive force in constraining the incumbent's pricing of the new network, so *ex post* we would then have a new monopoly.

This certainly is not the end of the discussion: after all, a new monopoly is created by any drastic innovation that is not readily imitable (e.g. if it is subject to intellectual property protection), and we do not generically treat this as a strong reason to require immediate sharing of such an innovation at cost-based prices. This is, of course, because of the *ex ante* consequences (see Principle B): such a rule would gravely weaken incentives for innovation. Thus it is crucial to consider these *ex ante* effects carefully.

Ex ante *competitive analysis*. One possibility is that the prospect of an unregulated (or little regulated) *ex post* natural monopoly might induce fierce Schumpeterian competition to occupy that lucrative position. Indeed, the *ex ante* competition to occupy it first might (perhaps even inefficiently) dissipate the potential *ex post* profits. Competition 'for the market' might be fierce, even though (or rather because) competition 'in the market' would be limited. From this point of view one would concentrate attention on ensuring that all potential competitors are genuinely as well placed as possible for this Schumpeterian race: in particular, if (as seems plausible) network effects and economies of scope are initially shared as between old and new networks, one would want to ask whether the incumbent's position gives it an unassailable head start, in which case for-the-market competition would be hamstrung. (Noting this does not, of course, immediately tell us what (if anything) to do about it.)

Even if for-the-market competition were vigorous, and presumably all the more so if it were not, it might be desirable to strengthen (prospective) competition 'in the market' even if doing so may weaken competition 'for the market'. More concretely, we should consider whether or not it would be wise to require sharing of innovative (e.g. 'broadband') dominant positions after some proprietary period akin to a patent term. Or would the effect on for-the-market competition likely be more severe and more important than the in-the-market effects?

A fundamental problem here is that potential innovators may be wary of innovating before the rules are decided, because of regulatory uncertainty and more specifically because the policy trade-offs change once the innovation has been made. Therefore it would seem wise to address in advance, rather than after the fact, the policy problem of how much sharing of broadband or other innovative ILEC infrastructure should be required. As in patent and copyright policy, the trade-off between *ex ante* competition 'for the market' and *ex post* competition 'in the market' should be addressed as early as possible.

One important ingredient of that trade-off is how strong the *ex ante* competition for the market will be (for any given degree of anticipated *ex post* competition in the market). Specifically, if (for whatever reason) the incumbent has a strong first-mover advantage in broadband overbuilds, then the asymmetry of positions in the *ex ante* competition might weaken that competition to the point where it may not be worth sacrificing very much *ex post* competition for it. (In 'innovation market' terminology, if the innovation market were substantially monopolized because of a dominant position in the existing good, it would call for different innovation policies.) This would depend on a variety of factors, such as:

- whether economic 'network effects' are importantly common as between broadband and conventional networks, and, if so, to what extent today's policies succeed in making those network effects available to entrants as well as to the incumbent;[18]
- whether, in particular, standard-setting processes for broadband infrastructure and/or services would enable currently powerful players to block others' innovations;
- the ability and will of cable companies to turn their fiber and/or coaxial networks into more general broadband networks.

Ex ante *analysis*: a policy of deregulating sharing of new network elements provided the old remain available would enhance an incumbent's incentive to make such investments, and to leave the old investment in place rather than rip it out.

Such a policy would also affect non-incumbents' incentives. Leasing unbundled elements might become viewed more as a stepping stone to facilities-based competition, because a carrier who tries to rely permanently on the incumbent's facilities would risk being overbuilt out of business not only by other competitors but also by the incumbent. In other words, the contemplated policy might fit better with the 'stepping stone' interpretation than with the 'efficient sharing' interpretation; the latter would lead us to worry somewhat more about the effects on entrants' rights to share the overbuild.

Implementation: how would we ensure that the old facility is indeed maintained and made available for competition? One possible answer is that

[18] If those 'carry-over' effects are important, then today's network-sharing provisions could be seen as de-monopolization policy for the infrastructure innovation market, as well as—the more conventional view—for today's telecommunications services market, including innovation in services over today's network.

the incumbent could *divest* the old facility. Divestiture would presumably require less regulatory intervention than today's provisioning and maintenance requirements, and would increase the flexibility and entrepreneurial spirit with which the asset would be offered to the market. On the other hand, there could be problems of collusion; two is not necessarily enough for competition.

5. *Limiting the Scope of Subsidies (Principle D)*

In telecommunications, some end-users currently are charged below cost—in some cases much below cost. This kind of entitlement creates competitive problems if those subsidies are funded by implicit cross-subsidies from other users who pay above cost, or if they are funded explicitly but not all competitors are equally able to receive the subsidy. As Lawrence White has quotably noted, 'cross-subsidies are the enemy of competition, because competition is the enemy of cross-subsidies'.

Congress addressed this problem in Section 254 of the Communications Act, instructing regulators to produce a system of explicit subsidies. As instructed, in May 1997 the FCC (broadly following the recommendations of a Federal–State Joint Board) adopted a plan for such a system. It will go a long way towards addressing the problem, compared with today's system of implicit subsidies. By making large parts of the old system of implicit subsidies explicit instead, it will make it possible in principle for competition not to threaten desired subsidies, and will thus make it possible for those who desire the subsidies not to fight competition.

Nevertheless, regulators probably cannot identify and make explicit *all* implicit subsidies (and it might well be damaging to try). Even within a relatively small area, customers differ greatly in how profitable they are to serve. Thus, as long as incumbents are subject to carrier-of-last-resort obligations, they will have colorable claims that competition is at least partly inefficient 'cream-skimming'.[19]

Perhaps in an attempt to resolve this problem, Section 254(e) of the Communications Act states that only a carrier declared 'eligible' under Section 214(e) may receive the subsidy, and Section 214(e) says that eligibility requires a carrier to offer service throughout a state-defined 'service area'. (This is a necessary, though seemingly not a sufficient, condition for

[19] This problem is, of course, reduced by access reform and other rebalancing initiatives that bring prices closer to costs, and by regulatory flexibility that lets incumbents set prices closer to costs. On the other hand, it is likely exacerbated by policies that facilitate competitive entry.

eligibility.) These two subsections partially protect remaining implicit cross-subsidies by restricting the forms of competition that can receive explicit subsidies, thereby discouraging other forms, perhaps including those most threatening to the remaining implicit subsidies. Some kinds of geographic specialization are permitted: those who serve only customers within a single state, for instance, are apparently eligible. But other kinds of specialization, such as service offered only to Internet users, are ineligible. I see this as a compromise between allowing unrestricted competition and avoiding cream-skimming. As such, it inevitably compromises competition to some degree.

I am not arguing here that the subsections (e) are unwise. Rather, my point is that subsidy problems are difficult and their solutions will inevitably often be competitively troubling. Therefore I think it will be important in moving to deregulation that these broad subsidy entitlement programs be limited.

Politically, however, some entitlements may be so entrenched that a strategy that relies on eliminating them will fail. Accordingly, I want to explore the idea that we can say at some point 'The subsidy buck stops here'.

By this I mean that in defining the services to be subsidized, we should be rather slow to include 'new' services. Such a policy will remove an important obstacle to deregulating (or not regulating) those services. Moreover, as more people move to the deregulated sector because the offerings are more appealing, it will help even in limiting subsidy/competition problems in the old, regulated sector (just by reducing the size of the required subsidy fund, if nothing else). Because of this, I fear that provisions such as Sections 254(b)(2), 254(b)(3) and 254(c)(1) of the Communications Act could be very damaging to competition and deregulation if too enthusiastically interpreted.

An Illustrative Specific Proposal

Moving to specifics, I would like to propose that there is no need to subsidize second lines. A regulatory version of this proposal would involve moving the (still regulated) prices for second lines 'to cost'. I think that would be a valuable step in the right direction. However, in part because many households are wired as a matter of course with two (sometimes more) lines even if only one is initially used, it is somewhat unclear what is the right concept of 'cost' of the second line. To establish conceptually a limit on the scope of subsidy, perhaps it hardly matters psychologically what measure of cost is used.

But here is a possible test of our willingness to change the presumption of regulation: perhaps we should actually ***deregulate*** the provision of second

residential lines, establishing a conceptual limit not merely on subsidy but on regulation. Applying Principle A, this proposal is a little like the 'immediate deregulation option' in Section 2 above, but the trade-offs seem much less threatening because it is limited to a part of the market where (i) there is more immediate competitive discipline (so the economics may be better) and (ii) there is less reason to worry about harm to low-income or otherwise highly vulnerable consumers (so the politics are surely better; cf. Principle D); moreover, I have in mind deregulating only end-user charges, so no issues of prices to competitors (potentially implicating Principle C) need arise.

For several reasons, I doubt that the prices charged for such lines would go up very dramatically if deregulated (while first lines remain regulated). First, few households *must* have a second line. For some users, especially those who plan to use their second line for 'overflow' conversation (that is, when more than one household member wants to make calls at once), wireless would be an acceptable, and in some ways better, substitute for a second wireline;[20] at low usage levels, wireless is already not very expensive, and wireless companies already claim some success in marketing as alternatives to second lines. For some other users (who use second lines largely for data, perhaps especially Internet use), cable modems are or will be very attractive once the cable industry gets its telecommunications act together. Multi-line households will presumably be among the first to become attractive to competitors. And no doubt 'cheating' by putting a second line in a second name (thus getting the still-regulated first-line price) would often be easy.

Obviously it is possible that, despite those sources of demand elasticity, an incumbent would raise second-line prices significantly (and well above costs). But the fact that there are some reasonable alternatives might make it politically easier to overcome objections from those who want to keep subsidized rates. To get this effect, however, it would probably be important to deregulate soon, while second lines are still generally viewed as a luxury,[21] so that people feel at least a hint of shame in arguing that they must be subsidized.

Reverting to Principle A and to economists' two messages for regulators, one must note that allowing incumbents to increase the price of second lines, which probably have considerably lower incremental costs than first lines and surely have much higher demand elasticity, goes against the traditional advice

[20] This might be particularly true as wireless providers develop products that function as 'cellular' or 'mobile' phones when far from home and as 'cordless' phones when near it.

[21] FCC staff have estimated that ~15% of US households had additional residential line(s) as of December 1995, and the number seems to have been growing rapidly (Common Carrier Bureau, FCC, 1997, Table 19).

to base prices on incremental costs and to follow Ramsey on linking mark-ups to elasticities. More concretely, it will inefficiently deter households from having second lines, hurting parent–teenager relationships and slowing the growth of residential Internet use, among other things. Despite this, I think it is wise policy, partly because (Principle B) any such price increases may attract more competition, but largely for symbolic reasons: it is a feasible immediate step away from the culture of entitlement and towards the possibility of deregulation, which I believe is more important (as well as more likely to happen) than regulatory respect for Ramsey.

Acknowledgements

On May 9, 1997, I gave a speech as Chief Economist at the FCC, on prospects for deregulation in telecommunications. This article is a re-organized and revised version of that speech. I thank Glenn Woroch and Alfred Kahn for helpful comments on a previous draft; of course they are not implicated in my views nor in my attempts to be provocative. I thank Mario Bergara for research assistance and the Consortium for Telecommunications Policy for funding his assistance.

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Interconnection Pricing, Stranded Costs, and the Optimal Regulatory Contract

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Given the potential for strategic gaming inherent in network providers' reliance on their competitors for the supply of vital inputs, interconnection pricing or the setting of prices at which networks sell access to their facilities and their customers to other networks has become a critical issue in the design of policies to promote competition in telecommunications markets. Debate has focused on the prices entrants should pay for access to the facilities and customers on the incumbent local exchange carriers (ILECs) who until recently were protected monopolies. A critical question is the size of the contributions competitors should make to incumbents' fixed costs and regulatory burdens in the prices they pay for network elements and services purchased from ILECs.

1. *Introduction*

Networks must be interconnected if the policy goal of ubiquitous connectivity for customers is to be realized. But interconnected networks sell absolutely essential inputs to their competitors—access to their own subscribers and access to the transmission facilities required to connect to still other networks and those networks' subscribers. Given the potential for strategic gaming inherent in firms' reliance on their competitors for the supply of vital inputs, it is not surprising that interconnection pricing—the setting of prices at which networks sell access to their facilities and their customers to other networks—has become a critical issue in the design of policies to promote competition in telecommunications markets.

To date, most of the policy attention, research and academic debate over interconnection pricing has focused on the prices entrants should pay for access to the facilities (and customers) of the incumbent local exchange carriers (ILECs) who until recently were protected monopolies. The intense

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STRATEGIC POLICY RESEARCH

UNE PRICES AND TELECOMMUNICATIONS INVESTMENT

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1. INTRODUCTION

In earlier comments, we observed that unbundling requirements reduce the profitability of incumbent local exchange carrier ("ILEC") investments and thereby afford disincentives to make such investments.[1] These disincentives almost surely make a large difference with respect to discretionary infrastructure investment. Such investment, itself, generates unbundling requirements to which the ILEC would otherwise not be subject. If the ILEC does not make the investment, the new facilities will not exist and therefore cannot be subject to unbundling requirements. Unbundling requirements afford ILECs the incentive to do just that—not make the investment. More generally, unbundling requirements inherently reduce ILEC profitability and thereby make all ILEC investments less attractive.

As a theoretical matter, this argument seems unexceptionable. How could it be otherwise? *Ceteris paribus*, a firm is more likely to make infrastructure investments that do *not* come with

[1] John Haring and Harry M. Shooshan, "Reorienting Regulation: Toward a More Facilities-Friendly Local Competition Policy," before the FCC, *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability* in CC Docket Nos. 01-338; 96-98 and 98-147, Attachment A to *Comments of Qwest Communications International Inc.*, April 5, 2002.

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an unbundling obligation attached than those that do. A firm is likely to invest more if investments are more profitable than if they are less profitable.

The only issue, it would seem, is the empirical magnitude of the likely diminution of investment and whether that diminution is balanced by comparably important public-policy goals.

We believe that unbundling requirements have already substantially curtailed ILEC investment. For example, SBC's withdrawal from Project Pronto, together with cut-backs in other ILEC investments to support mass DSL deployment, amount to billions of dollars.[2] This amount is quite sizable, in itself. Moreover, the preliminary statistical evidence we present herein suggests that the adverse consequences of unbundling for ILEC investment may be even more pervasive and substantial.

At the same time, we believe that extreme unbundling requirements do little to further the competitive goals for which they were designed and are thus uneconomic. In particular, they provide an attractive alternative to CLEC investments in their own facilities. UNEs involve far less risk than facilities investments and can be quite profitable, given the low levels of UNE prices.[3] Nonetheless, UNE-based competition is not nearly as beneficial to the public as facilities-based competition.

AT&T posits a view that is contrary to ours. Their reasoning, as we understand it, is as follows:

> Low UNE prices stimulate UNE-based entry. The UNE-based competitors will ultimately migrate from the use of UNEs to their own facilities. The ILECs will then be stimulated to make investments to modernize their networks to be competitive.

Unlike the unexceptionable theory that we proffered above, this theory is a parlay of events of questionable likelihood. Low UNE prices may, indeed, stimulate UNE-based entry. But:

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[2] John Haring and Jeffrey H. Rohlfs, "The Disincentives for Broadband Deployment Afforded by the FCC's Unbundling Policies," presented before the FCC, *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability* in CC Docket Nos. 01-338; 96-98 and 98-147 as Attachment to *Comments of High-Tech Broadband Coalition*, April 5, 2002.

[3] *See, for example*, Strategic Policy Research, Inc., *TELCOMP© Model Version 1.4*, submitted before the FCC, June 17, 1999 (available at www.spri.com).

- It may be a long time, if ever, before UNE-based competitors migrate to using their own facilities. UNEs are cheap and involve little risk. Also, the customers may be dispersed, so that construction of facilities is not cost-effective—given the attractive alternative of UNEs.
- The hoped-for ILEC investments may not be profitable. In the future world in which competition is much more intense, ILECs will often have to give up customers to competitors, because doing what is necessary to retain the customers will be unprofitable. It is especially likely to be unprofitable if the investments are subject to onerous unbundling requirements and especially if UNE prices are below cost.

Since the reasoning underlying AT&T's theory is far from conclusive—indeed, in our view, highly speculative—the theory requires particularly strong empirical support to be at all persuasive. (Of course, empirical support would be desirable, even if the theory were much more strongly grounded.) Without such empirical support, the theory would simply be a set of improbable self-serving speculations.

AT&T sought to meet the need for empirical evidence by filing an econometric study by Robert D. Willig, *et al.*[4] The Willig study, however, suffers from a number of serious defects, which make its results suspect. These defects include the following:

- The model of ILEC investment is based on a "back-to-the-future" process, whereby future events reach back and change the past;
- The dependent variable in the equation for CLEC investment—number of firms—is an inadequate measure of degree of competition;
- The model includes too many explanatory variables, relative to the number of supporting observations. The results of such models are neither robust nor reliable; and
- Notwithstanding Willig's use of many explanatory variables, the model omits some obvious variables (in particular, loops and level of state economic activity) that likely have more explanatory power than many of the included variables. We believe that Willig's model would be substantially improved by including these critical variables and omitting several of the less significant variables; and

[4] Declaration of Robert D. Willig, before the FCC, *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability* in CC Docket Nos. 01-338; 96-98 and 98-147, Attachment F to *Comments of AT&T Corporation*, April 5, 2002 (hereinafter "Declaration").

- The model additionally has several debilitating technical defects, described herein.

2. CRITIQUE OF WILLIG

The dependent variable in the Willig model is growth of per-capita ILEC net plant from 1996 to 2000. Willig seeks to explain this growth in investment in terms of a variety of influences: per-capita ILEC net plant in 1996, the percent of each state's labor force that is employed in finance, insurance and real estate industries, the growth in statewide population from 1990-2000, the average unemployment rate for the period 1996-2000, average total residential revenues per line, the unbundled network element platform ("UNE-P") price in zone 1 for 2001,[5] total element long-run incremental cost ("TELRIC") of the UNE-P from the FCC's Synthesis Model, total service resale discount for 2001, and the regulatory treatment of ILEC retail services in 2000, according to an NRRI table.[6]

2.1. BACK TO THE FUTURE

The Willig model embodies the illogic of relying upon data from future years, primarily 2000 and 2001, to "explain" past ILEC investment decisions (1996-2000). It simply defies commonsense, however, to suggest that ILECs determined their investment levels in 1996 based on as-yet-nonexistent UNE-P prices that prevailed in 2001.

In particular, AT&T has clarified in an *ex parte* filing that Willig relied explicitly upon the UNE-P prices for 2001 as an explanatory variable of ILEC investment back as far as 1996.[7] Willig gives no explanation of how the UNE-P prices "reach back" and affect investment in *earlier* years. UNE prices were generally not set in 1996 and had not been completely resolved in as many as 19 states as of late 1999.[8] In those early years, even the methodology for determining

[5] The source for UNE-P prices was clarified when AT&T filed with the FCC a "Description of the Data and Econometric Processes Used in the Analysis Prepared by Professor Willig," (June 28, 2002) (hereinafter "Further Description").

[6] Willig describes his data and methods in Exhibit 2 and presents his results in Exhibit 3 to his Declaration.

[7] Willig acknowledges the shortcoming of the use of UNE prices for 2001 and says that the UNE rate and discount rates that reflect the 1996-2000 period of interest would be ideal. Willig was "not aware of a source for such average data" ("Further Description" at 3). We are surprised by this lack of data given that AT&T is presumably well positioned to know what those rates have been over the course of the period in question. AT&T has been a participant in UNE pricing proceedings and arbitrations in almost every state.

[8] These conclusions are based on SPR's survey of UNE rates across the 50 states in 1998 and update in 1999. In many instances there were "temporary" prices to be replaced with "final" prices following extensive cost *(footnote continued)*

UNE prices had not yet been established. Indeed, TELRIC pricing methodology was confirmed by the Supreme Court only as recently as May 2002.[9] In the meantime, the prices, themselves, changed from "temporary" prices to "final" prices, and then changed again in response to remands from courts. Willig's reliance on UNE-P prices, rather than (say) the UNE loop price compounds this problem. UNE-Ps are a relatively recent development, and even now, it is far from clear that they can survive the recent court remand.[10] There is certainly no economic basis to conjecture or theorize that ILEC investment decisions from 1996-2000 were caused by the 2001 UNE-P price.

Similarly, the use of the resale discount and number of CLECs operating in each state in June 2001 to explain ILEC investment in *prior* years, suffers the same infirmities as the use of the 2001 UNE-P price. No one in 1996 could have predicted resale discounts or the extent of competition (or other variables) over the next 4 years with any precision on a state-by-state basis.

2.2. NUMBER OF CLECS IS AN INADEQUATE MEASURE OF THE DEGREE OF COMPETITION

A serious defect of the Willig CLEC entry equation is its measure of the degree of competition; *viz.*, the logarithm of the number of CLECs. It is well understood among economists that the number of firms in an industry is, in itself, often not indicative of much of anything. Economic consequences always depend on the size of firms, as well as their number. One would, for example, never measure industry concentration in terms of the number of firms in an industry.[11] The measure works poorly in the instant case for the same reasons. In particular, a few large CLECs could be far more consequential than many small ones.

Better measures of the degree of competition are number of total CLEC lines or number of facilities-based CLEC lines. These measures indicate the success that CLECs have had to date in attracting customers. In contrast, a larger number of CLECs does not necessarily indicate greater success in attracting customers.

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proceedings. Some states such as Pennsylvania, New Mexico and Idaho had no prices in place that we were able to observe as late as 1999. We noticed even further changes (reductions primarily) in UNE loop prices in 2002 from 2001 levels in Commerce Capital Markets, Inc., studies of November 12, 2001 and May 1, 2002.

[9] Supreme Court of the United States, No. 00-511, *Verizon Communications et al. v. FCC et al.* (decided May 13, 2002).

[10] *USTA et al. v. FCC et al.*, United States Court of Appeals for the District of Columbia, No. 00-1012 (decided May 24, 2002) (hereinafter *USTA v. FCC*).

[11] Commonly used alternatives are the Hirschman-Herfindahl Index ("HHI") or the concentration ratio.

Another important measure of the degree of competition is the capacity of facilities-based CLECs.[12] This measure indicates how much competitive pressure facilities-based CLECs can put on ILECs. Such CLECs can take business away from ILECs to the extent that they have facilities in place to handle the business. Again, the number of CLECs does not indicate the degree to which facilities-based CLECs have capacity in place to take business away from ILECs.

2.3. TOO MANY VARIABLES

Willig's model is a cross-sectional analysis consisting of 37-38 observations. At the same time, the ILEC investment equations include *12* explanatory variables, in addition to the constant term. While the specific number of variables that should be included in a model is a subjective judgment, the use of 12 variables to explain 37 or 38 observations is excessive and makes it virtually impossible to obtain robust results.

In the most general terms, the goal of econometric modeling is to explain a lot with a little. A model with 38 observations and 12 explanatory variables is an extreme case of the opposite: explaining a little with a lot.

That approach is especially problematic in statistical analysis. With so few observations relative to potential explanatory variables (or combinations thereof), one can "prove" almost any desired result—certainly to the level of "marginal significance" that the Willig study reports. This is so, even if the variables are constrained to the seemingly "reasonable." There are so many combinations of seemingly reasonable variables that at least one combination is likely to yield the desired result, simply through random chance.[13]

2.4. MISSING VARIABLES

While including many variables in the ILEC investment models, Willig leaves out some critical and, in fact, rather obvious candidates: number of loops served by the ILEC(s) (included in the study) in each state and gross state product ("GSP") of each state.

It is reasonable to treat the number of ILEC loops as exogenous. Demand for loops is very inelastic, and ILECs are required to meet increases in demand. Loops are probably the best indicator of the amount of non-discretionary investment the ILEC must make. The required

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[12] Measures of capacity might, for example, reflect the numbers of lines that could be supplied in particular geographic areas without deploying additional fiber.

[13] For example, if there are 10 candidate seemingly reasonable variables, they can be entered in the equation in 3.6 million possible combinations.

switching investment, as well as the required loop investment, to accommodate growth are closely related to the growth in loops.

GSP is another variable that can explain a significant part of ILEC investment. Demand for telecommunications services, and the associated need for ILEC investment, are related to the level of economic activity of the state. ILEC investment depends on the "permanent" level of state income as well as on macro-economic fluctuations, which might be picked up in Willig's unemployment variable. For example, New York has higher per-capita income than Mississippi, even when the unemployment rates in the two states are equal.

The Willig model does not include either of these very plausible variables. Nor does Willig report any further statistical tests involving alternative model runs including these variables.

Thus, the possibility exists that substituting these variables for some of the variables that are used in Willig's study, but have little explanatory power (especially when the additional variables are included), might make a significant difference in the results of the study. It could conceivably have the effect of reversing Willig's results.[14]

2.5. MISMATCHED GEOGRAPHICAL COVERAGE

Willig, in his "Further Description" states that he obtained total plant in service ("TPIS") and accumulated depreciation for "each of the major ILECs in Table 43-02 B6 Summary of Investment and Accumulated Depreciation."[15] A review of the list of ILECs on that table shows that only Regional Bell Operating Companies ("RBOCs"), including former GTE and SNET properties, as well as Puerto Rico Telephone Company are represented. Major ILECs missing from that table include Sprint, Alltel and Citizens, which have large study areas in many states. Further, Rochester Telephone and Cincinnati Bell each serve a fairly large metropolitan area in their respective states, New York and Ohio, and are not included in the database that Willig relies upon. Small ILECs are entirely excluded.

This incomplete coverage is not, in itself, a problem. It becomes a problem, because Willig scales the data by dividing by *statewide population*. In some states, such as Nevada, where Sprint has a major presence, normalizing net plant data by statewide population skews the data. Nevada Bell's per-capita net plant is low for reasons completely unrelated to the model. Comparisons to Verizon's per-capita net plant in Delaware or Rhode Island, for example, where Verizon is the only ILEC, make little sense. This improper scaling leads to biased results.

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[14] We received the data underlying the Willig study on July 12, 2002 and have only begun our review of these data. We anticipate conducting analyses and reporting our findings to the FCC in the fullness of time.

[15] "Further Description" at 1.

2.6. INVESTMENTS REQUIRED TO SUPPORT UNE-BASED ENTRY

The data upon which Willig relies, ARMIS data, include all investment made by ILECs. This investment includes the investments that ILECs have been *required* to make to support UNE-based CLECs. In particular, ILECs have made significant investments to accommodate collocators in their central office and remote terminals.[16] Such investment—unlike investments to support innovative new services—provides no direct benefit to customers. They are simply part of the cost of UNE-based competition.

Our view, stated above, is that unbundling requirements reduce discretionary ILEC investment, which directly benefits the ILEC's retail customers. To refute this view, Willig would have to show that the alleged increase in ILEC investment exceeded what was required to accommodate UNE-based competitors. The Willig study cannot make this demonstration on the basis of the data analyzed.[17]

2.7. SIZE OF STATE

There is no variable in the CLEC entry equation to account for the variation in size among states, particularly in terms of population. One would presumably expect more competitors in a larger state, such as New York, than in a smaller state, such as Utah. The Willig model does not reflect this consideration.

Moreover, none of the explanatory variables reflect the level of economic activity in a state. (An example of such a variable is GSP (or its logarithm), as discussed earlier.) Thus, Willig is trying to model the number of CLECs in a state without reference to the amount of economic activity in the state (or to its population).

In general, a model that omitted key variables would have little chance of fitting the data satisfactorily. As discussed above, however, one can get just about any desired result in a model with 12 explanatory variables and only 38 observations.

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[16] SBC has described the remote terminals that are a component of its broadband deployment plans (see *ex parte* letter of James K. Smith, SBC, to William F. Caton, Acting Secretary, FCC, March 25, 2002). In this presentation, SBC states that "providing CLEC access as described will increase initial [broadband] infrastructure costs alone by at least 20 percent." SBC estimates the financial impacts of requirements of the "Pronto Waiver Order" to be over $200 million.

[17] The D.C. Circuit raised this very question: "How such investment [made with unbundling policies in effect] compares with what would have occurred in the absence of the prospect of unbundling." While the court did not necessarily require econometric models, as we are exploring in this proceeding, it did "expect at least some confrontation of the issue and some effort to make reasonable trade-offs." *USTA v. FCC.*

2.8. ECONOMETRIC IDENTIFICATION

Willig posits a two-step process whereby low UNE prices lead to an increase in ILEC investment. The first step is that low UNE prices lead to increased CLEC competition. The second step is that increased CLEC competition leads to increased ILEC investment.

To estimate this model, Willig specifies two equations for ILEC investment. The first is the reduced form, in which all explanatory variables are presumed exogenous. The logarithm of the number of CLECs, which is endogenous, does not appear in the reduced form. The second equation is a structural equation, which includes both exogenous and endogenous variables. In the Willig model, this equation includes the endogenous variable, the logarithm of the number of CLECs.

A well-known theorem in econometrics is as follows: The coefficients of a structural equation are "identified" and can be estimated only if the equation excludes one or more exogenous variables that are in the reduced form.[18] For identification, the exclusion must be *a priori*. That is, it cannot simply be based on a lack of correlation in the sample. One must be able to reason on the basis of one's general understanding of the market that the excluded variables do not affect the dependent variable. Examples of excluded variables are as follows:

- Wage rates affect supply, but they are excluded from the demand equation; and
- Consumer income affects demand but is excluded from the supply equation.

In both these cases, the endogenous variable would be the price of the good. In each equation, the excluded variable does not affect the dependent variable *directly*. It does, however, affect it *indirectly* through its effect on the endogenous variable.

In the Willig model, the excluded variables are the UNE price and the resale discount. The underlying theory is that these variables affect ILEC investment *only* through their effect on the degree of competition.

This theory is completely implausible. The UNE price and the resale discount both affect ILEC profits directly. The higher the UNE price, the more profit the ILEC makes on sales of UNEs. The lower the resale discount, the more profit the ILEC makes on resold services. It is completely unreasonable to specify that these effects on profits have no influence whatever on

[18] *See, for example*, Jack Johnston and John Dinardo, *Econometric Methods*, Fourth Ed. (New York: McGraw-Hill, 1997) at 309-316. In certain special circumstances, a model may be identified by restrictions other than the exclusion of variables, but these circumstances do not apply to the Willig model.

ILEC investment. Yet, that is precisely the specification of the Willig structural equation for ILEC investment.

Given that the UNE price and the resale discount are not really excluded from the ILEC investment reduced-form equation, Willig's structural equation is not identified. Thus, the estimates of the coefficients of the structural equation are biased.

In general, if a structural equation is not identified, the estimated coefficients include effects from the other equation(s). In this case, the estimated coefficients in the ILEC investment equation include effects relating the same variables in the CLEC equation. This bias remains, no matter how large the sample. It cannot be detected by standard statistical tests. Consequently, ensuring that structural equations are really identified is a critical part of econometric technique.

This consideration completely invalidates the results of Willig's structural equation for ILEC investment.

2.9. PRICE REGULATION

Willig includes regulatory conditions faced by major ILECs in his model to explain ILEC investment from 1996-2000. Often, whether a price cap plan is approved for an ILEC, as well as its terms, depend on the ILEC's agreeing to make certain investments in its network in that state. In this sense, a price cap plan *causes* the investment that may *follow*—again here we have the back-to-the-future issue—in the next period.[19] On the other hand, the state regulator may regulate more stringently or decline to permit price cap regulation based on *past* performance of the ILEC in terms of maintaining service quality through necessary upgrades and repairs to its network. In this latter sense, investment *causes* the regulatory condition that would be faced in the future. A further point is that ILECs are more disposed to make infrastructure commitments if those investments are likely to be profitable; e.g., because unbundling requirements are less onerous.

For these reasons, the method of regulation should be regarded as endogenous. It should not be included in the reduced form equation for ILEC investment, as it is in the Willig model. To properly include these regulatory variables, Willig would need to specify an identified structural equation. In this regard, the preceding section noted that Willig's structural equation for ILEC investment is not really identified, as it stands. Treating additional variables as endogenous would make the identification problem even more difficult to solve.

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[19] Our review of the state regulatory conditions faced by ILECs shows that not many significant changes occurred between 1996 and 1999. A number of state price regulation plans were renewed or revised during 1999-2001. *See State Telephone Regulation Report*, February 15, March 1, and March 15, 2002.

3. ALTERNATIVE ECONOMETRIC MODELS

In light of the infirmities of the Willig model, we have developed an alternative model to explain ILEC investment. Our goal is the same as Willig's: to explain ILEC investment, paying special attention to the effect of the UNE price. This exercise involves controlling for other variables that materially affect ILEC investment. We attempted to carry out the estimation, avoiding the many debilitating weaknesses of the Willig analysis.

The dependent variable in our analysis is similar to Willig's—net plant. Willig has a cross-sectional model in which the dependent variable is (incremental) investment between 1996 and 2000. Our model is a cross-sectional model for 2001. The model has 48 observations[20] and only 4 explanatory variables, in addition to the constant term, and corrects for heteroskedasticity. The model fits the data better than the Willig model and has far superior statistical properties, in particular regarding statistical significance of coefficients.[21] It also avoids the modeling defects of the Willig model, as described above.

Our results are preliminary and certainly do not reflect a comprehensive analysis of ILEC investment. Nevertheless, they suffice to show that Willig's results are not implied by the data. On the contrary, they derive from the many defects of the Willig model. An alternative formulation that does not embody those defects yields opposite results.

3.1. SPR'S ANALYSIS

We restricted our analysis to RBOCs, because more data are available for RBOCs than for other carriers. In particular, we found data on UNE loop prices not to be readily available except for RBOCs.

For our dependent variable, we use the level of net plant. We could not scale net plant by statewide population because in many states RBOCs do not serve the whole state. (See Section 2.7 above.) Because the data are not scaled, we corrected for heteroskedasticity to reflect that model errors are likely to have greater variance in larger states than in smaller states.

[20] The only states excluded were Alaska, Connecticut and Hawaii, which do not contain original RBOC study areas, and thus lack UNE price data and, in the case of Alaska and Hawaii, also lack relevant ARMIS data. All references to RBOCs are to original RBOC study areas.

[21] As we describe in the Appendix, we were able to obtain some of the same data that Willig relied on. We also collected data for important explanatory variables that we thought were improperly excluded from the Willig model: RBOC loops and GSP.

We lacked adequate time-series data (particularly of UNE prices) to develop a stock adjustment model or a model with lagged explanatory variables. The 2001 observations for which we had complete UNE loop price data became the observations in our cross-sectional analysis. Our explanatory variables are contemporaneous. We used the UNE loop price in the same period since the UNE loop remains a widely-used means of CLEC entry, and the UNE loop price is by far the largest component of the UNE-P price.[22] The data that we relied on are available to any interested party from SPR's website at http://www.spri.com.

We found that RBOC investment decisions in 2001 were driven by four major exogenous factors: the number of loops served by the RBOC in that state; the average annual number of unemployed persons in each state during 2001; the level of real GSP; and the UNE loop price in RBOC zone 1 multiplied by the number of RBOC loops. This last variable was constructed so that an increase of $1 per month in the UNE-loop price would have the same impact on ILEC investment *per loop* in Nevada as in New York. This formulation is reasonable. In contrast, a UNE price variable that was not multiplied by loops would have the unreasonable implication that $1 per-month increase has the same *overall dollar impact* on ILEC investment in Nevada as in New York.

We adjusted statewide variables of GSP and the number of unemployed persons by the ratio of RBOC switched loops in each state to total ILEC switched loops in that state. This adjustment reflects the fact that RBOC study areas cover varying portions of each state in which they operate. Further, since our model relies on levels instead of ratios (i.e., data not weighted by some relevant units), the number of unemployed persons is a more appropriate measure of unemployment than the unemployment rate.

These results rely upon exogenous variables that are not intertwined with various interdependent regulatory policies and are significant in their relation to the level of net plant in each RBOC study area. The explanatory variables are fairly obvious and have an economic basis for their inclusion.

The key finding of our analysis is that the UNE loop price has a positive relationship to ILEC investment, in direct contradiction to Willig's results, and is statistically significant at the 1 percent level—far from marginal. Thus, our results support what should be regarded as the expected result. Low UNE loop prices, which diminish the profitability of ILEC investment,

[22] It appears that resold lines nationwide dropped by more than 20 percent from December 2000 to June 2001, while reliance on UNE-P's ("UNEs with switching") increased by almost 70 percent. See FCC, Industry Analysis Division, "Local Telephone Competition: Status as of June 30, 2001" (February 2002) at Table 4. UNE loop use increased by over 75 percent as well, suggesting that the very low prices of the UNE loop and UNE-P have become far more desirable means of entry than resale.

lead to a reduction in that investment. These results contradict Willig's contorted theory that diminished profitability leads to an *increase* in ILEC investment through increased CLEC competition. The results from our primary econometric model are presented below in Table 1.

Table 1

SPR Econometric Results: Model 1 **Dependent Variable: RBOC Net Plant**		
Variable	**Estimated Coefficient**	**t-statistic**
Constant	66,938,095	0.76
RBOC Loops	340	2.87**
Number of Unemployed Persons	-3,934	-1.12
Real Gross State Product ($M)	5,731	2.11*
RBOC Loops x UNE Loop Price Zone 1	18.05	4.50**
R-squared	0.99	
Adjusted R-Squared	0.98	
F-statistic (4, 43)	729	
Number of Observations	48	
* Significant at the 95 percent confidence level. ** Significant at the 99 percent confidence level.		

The variables for RBOCs loops and real GSP have the expected positive signs and plausible estimated values. The two coefficients are significant, at the 1 percent and 5 percent levels, respectively. The variable for the number of unemployed persons has the expected negative sign and a plausible estimated value. It is not, however, statistically significant.

The unemployment variable may materially (negatively) affect RBOC investment, notwithstanding its lack of significance in Model 1. Nevertheless, it is interesting to examine the effect of omitting the variable. In Table 2, below we present the result for Model 2 without the number of unemployed persons.

Table 2

SPR Econometric Results: Model 2 Dependent Variable: RBOC Net Plant		
Variable	**Estimated Coefficient**	**t-statistic**
Constant	53,899,352	0.59
RBOC Loops	275	2.59*
Real Gross State Product ($M)	4,407	1.60
RBOC Loops x UNE Loop Price Zone 1	19.89	4.63**
R-squared	0.98	
Adjusted R-Squared	0.98	
F-statistic (3, 44)	942	
Number of Observations	48	

* Significant at the 95 percent confidence level.

** Significant at the 99 percent confidence level.

With the omission of the unemployment variable, real GSP became less significant in Model 2. The variable appears to work better in conjunction with the unemployment variable, as in Model 1. GSP and unemployment can then separately reflect the differential effects of permanent and transitory income. In any event, the omission of the unemployment variable has little effect on the estimated coefficient for the UNE-loop price.

Table 3 shows results without *either* the GSP variable or the unemployment variable. In this model, the coefficient for RBOC loops probably serves, in part, as a proxy for size-of-state effects. Thus, the large coefficient for RBOC loops probably overestimates the effect of loops on RBOC investment. In this model, as in Model 2, the coefficient for the UNE-loop price remains approximately the same as in Model 1.

Table 3

SPR Econometric Results: Model 3 Dependent Variable: RBOC Net Plant		
Variable	**Estimated Coefficient**	**t-statistic**
Constant	-1,381,844	-0.02
RBOC Loops	453	11.65**
RBOC Loops x UNE Loop Price Zone 1	19.23	4.19**
R-squared	0.98	
Adjusted R-Squared	0.98	
F-statistic (2, 45)	1,208	
Number of Observations	48	
** Significant at the 99 percent confidence level.		

Our results appear to be robust. In the three models the UNE loop price estimated coefficient has remained stable, between 18 and 20, as less significant variables are removed. This range does not depend on any single model.

3.1.1. DISCRETIONARY AND NON-DISCRETIONARY ILEC INVESTMENT

The number of loops served in a given year captures incremental changes in net plant that results from an incremental change in the number of loops served. The estimated coefficient of this variable reflects the largely non-discretionary investment required to accommodate increases in demands for basic telephone services. The estimated coefficient in Model 1 indicates that each additional loop served by the RBOC causes an increase of $340 in RBOC net plant.

The variables of GSP (in Models 1 and 2) and average number of unemployed persons provide measures of the level of economic activity in the state. These reflect a combination of discretionary and non-discretionary investments. As economic activity rises, businesses and residents in the state demand more telecommunications services. In addition, increased economic activity may make it profitable for the ILEC to offer advanced innovative services.

Finally, the UNE loop price variable performed the best in Models 1 and 2, and remained highly significant in Model 3. These reflect discretionary investments that become profitable and are made if the UNE loop price is higher, but are deterred by a low UNE price. As discussed above, low UNE prices may be associated with greater non-discretionary ILEC expenditures to accommodate interconnection of UNE-based competitors. The positive coefficient in the equation is *net* of all such effects. Even so, it is large, positive, and highly statistically significant.

The impact of the UNE price on RBOC net plant in all of our models is directly the opposite of the result obtained by Willig. According to our Model 1 results, as the UNE loop price rises by $1 a month (per loop), RBOC net plant increases by about $18 *per loop*.[23] The inference from these results is that the effect of the UNE price on RBOC investment can become very sizable. For example, if the UNE price increased by, say, $5 per loop per month, the addition to RBOC net plant would be $90 per loop. This is over 25 percent of the additional net plant per additional loop.

3.2. CLEC ENTRY MODELING

It is unnecessary for us to develop our own CLEC entry model, because models that effectively refute the Willig model already exist. Two of particular interest are Ros-McDermott (R-McD)[24] and Eisner-Lehman (E-L).[25] These studies avoid many of the defects of the Willig study. Thus, the Willig model can be considered a step backward in the ongoing econometric analysis of CLEC entry.[26]

The key finding of these studies is that lower UNE prices did not necessarily yield greater CLEC entry. Further findings included evidence that higher residential rates appeared to encourage CLEC entry in general, and residential competition, in particular.

Unlike the Willig model, these models include some variable or variables relating to the size of the state. For example, R-McD consider population density, loop density, and the relative mix of GSP among major sectors of the state economy as determinants of CLEC entry. E-L used the level of and the change in employment (i.e., the number of persons employed) in the state. The use of the level of employment in particular provided a means of scaling among the states.[27]

Though these models are single period cross-sectional models, they each reflect the best data available to the authors at the time of their studies. For example, E-L had the advantage of

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[23] This interpretation derives from dividing both the unscaled UNE loop price and the RBOC net plant by the number of RBOC loops.

[24] Agustin Ros and Karl McDermott, "Are Residential Local Exchange Prices Too Low?," *Expanding Competition in Regulated Industries* Michael Crew, Ed. (Kluwer Academic Publisher: 2000).

[25] James Eisner and Dale E. Lehman, "Regulatory Behavior and Competitive Entry," for presentation at the 14th Annual Western Conference Center for Research in Regulated Industries (June 28, 2001).

[26] The analysis by FCC staff members Zolneirek-Eisner-Burton is an early model relying on the number of CLECs as the dependent variable as does Willig. Therefore, it does not provide much useful guidance for evaluating the state of the art in modeling CLEC entry today. [James Zolneirek, James Eisner and Ellen Burton, "An Empirical Examination of Entry Patterns in Local Telephone Markets," (August 23, 1999).]

[27] E-L at 11.

detailed data available to FCC staff only.[28] E-L went beyond earlier studies by examining each of the following: the number of resold lines, the number of UNE-based lines, the number of facilities-based lines, and total CLEC lines. E-L models of number of CLEC facilities-based and resold lines were of fairly good fit (with high R-squared).

The most interesting finding of E-L is that, contrary to expectations, there was no evidence that lower UNE rates would promote non-facility-based entry. The only evidence that lower UNE rates were associated with more entry (in general) is in states where 271 relief has been granted.[29] With regard to the effect of retail residential pricing on CLEC entry E-L obtained similar results as R-McD. R-McD found that, in states where residential and business retail rates were more balanced, there was greater evidence of facilities-based entry by CLECs.[30] Though E-L did not find evidence of the significance of the ratio of business to residential retail prices (they used different measures of business rates), they did find that higher retail residential rates tended to promote facilities-based competition.[31]

These earlier models, particularly E-L, obtained results contrary to that of Willig regarding the impact of UNE prices on CLEC entry. They suggest that it is debatable as to whether lower UNE prices increase competitive entry, even by use of UNEs. More generally, they have found that low UNE prices do *not* promote competition, especially facilities-based competition.

It is surprising that Willig did not reference these studies as he constructed his own model. In reality, these models are more advanced in important respects than Willig's and should be included in the public discourse on unbundling policies.

4. CONCLUSION

We reviewed herein the econometric models of Willig, *et al.*, which were filed in this proceeding by AT&T. We found that those models suffer from a number of fatal defects, which make their results suspect. These defects include the following:

[28] E-L at 6. E-L acknowledge some of their results differ from those of R-McD mostly because R-McD did not have access to the data available to E-L through Eisner's employment at the FCC. Different measures of business retail rates led to some different results as well.

[29] E-L at 20-21.

[30] See, R-McD at 15-17.

[31] E-L at 11.

- The model of ILEC investment is based on a "back-to-the-future" process, whereby future events reach back and change the past;
- The dependent variable in the equation for CLEC investment—number of firms—is an inadequate measure of degree of competition;
- The model includes too many explanatory variables, relative to the number of supporting observations. The results of such models are neither robust nor reliable;
- Notwithstanding Willig's use of many explanatory variables, the model omits some obvious variables (in particular, loops and level of state economic activity) that likely have more explanatory power than many of the included variables. We believe that Willig's model would be substantially improved by including these critical variables and omitting several of the less significant variables; and
- The model additionally has several debilitating technical defects.

In light of these defects, we developed our own econometric model of ILEC investment. It avoids the defects of the Willig model and has far better statistical properties. We found that contrary to Willig's model, low UNE prices repress ILEC investment. Our result is the opposite of surprising, since low UNE prices reduce the profitability of ILEC investments. In our model, UNE prices were one of the two most significant explanatory variables for ILEC investment, with total RBOC loops in service being the other. We found that an increase in the UNE loop price of $5 per month is associated with increased ILEC investment of $90 per line.

We did not develop our own model of CLEC entry. We did, however, review previous econometric studies that avoid many of the defects of the Willig model and get the opposite result. Those studies suggest that, contrary to Willig's result, low UNE prices do not promote CLEC competition.

APPENDIX

STRATEGIC POLICY RESEARCH

DATA SOURCES

SPR's model of ILEC investment relies on a cross-sectional database of observations from each Regional Bell Operating Company ("RBOC") state for which complete data were available.[1] SPR obtained from the FCC's ARMIS database total plant in service ("TPIS") and accumulated depreciation for each RBOC study area for 2001.[2] We calculated net plant for each study area each year as the difference between TPIS and accumulated depreciation.

We employ total RBOC loops in service in 2001 for each study area as an explanatory variable.[3] We obtained the average annual number of unemployed persons for each state for 2001 from the U.S. Bureau of Labor and Statistics.[4]

We relied on the RBOC Zone 1 UNE loop prices in each state for 2001 as reported by Commerce Capital Markets, Inc., in November 2001.[5] We then multiply this by total loops to scale the variable, comparable to other variables in the model. We estimated 2001 real GSP for each state using real GSP from 1996 to 2000. We also calculated the GSP index for each state to adjust UNE prices to real values.[6]

To calculate a ratio of RBOC to total ILEC loops in each state, we obtained total ILEC switched access lines in each state from the FCC's Trends in Telecommunications Report for 2000.[7] We

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[1] That is, each state in which an original RBOC (not including GTE, SNET or Cincinnati Bell properties) provides incumbent local exchange service. This excludes Alaska, Connecticut and Hawaii.

[2] Federal Communications Commission ("FCC"), *ARMIS Database 43-02: Table B6. Summary of Investment and Accumulated Depreciation.*

[3] FCC, *ARMIS Database, 43-08: Table III: Access Lines in Service.*

[4] U.S. Bureau of Labor and Statistics, *State and Regional Employment and Unemployment, 2001 Averages,* USDL 02-97 (February 22, 2002).

[5] Anna-Maria Kovacs, *et al.*, "Status and Implications of UNE-Platform in Regional Bell Markets," published by Commerce Capital Markets, Inc. (November 12, 2001).

[6] We obtained current dollar GSP as well as real GSP for each state for the years 1996-2000 using the U.S. Department of Commerce, Bureau of Economics online database (data released June 10, 2002).

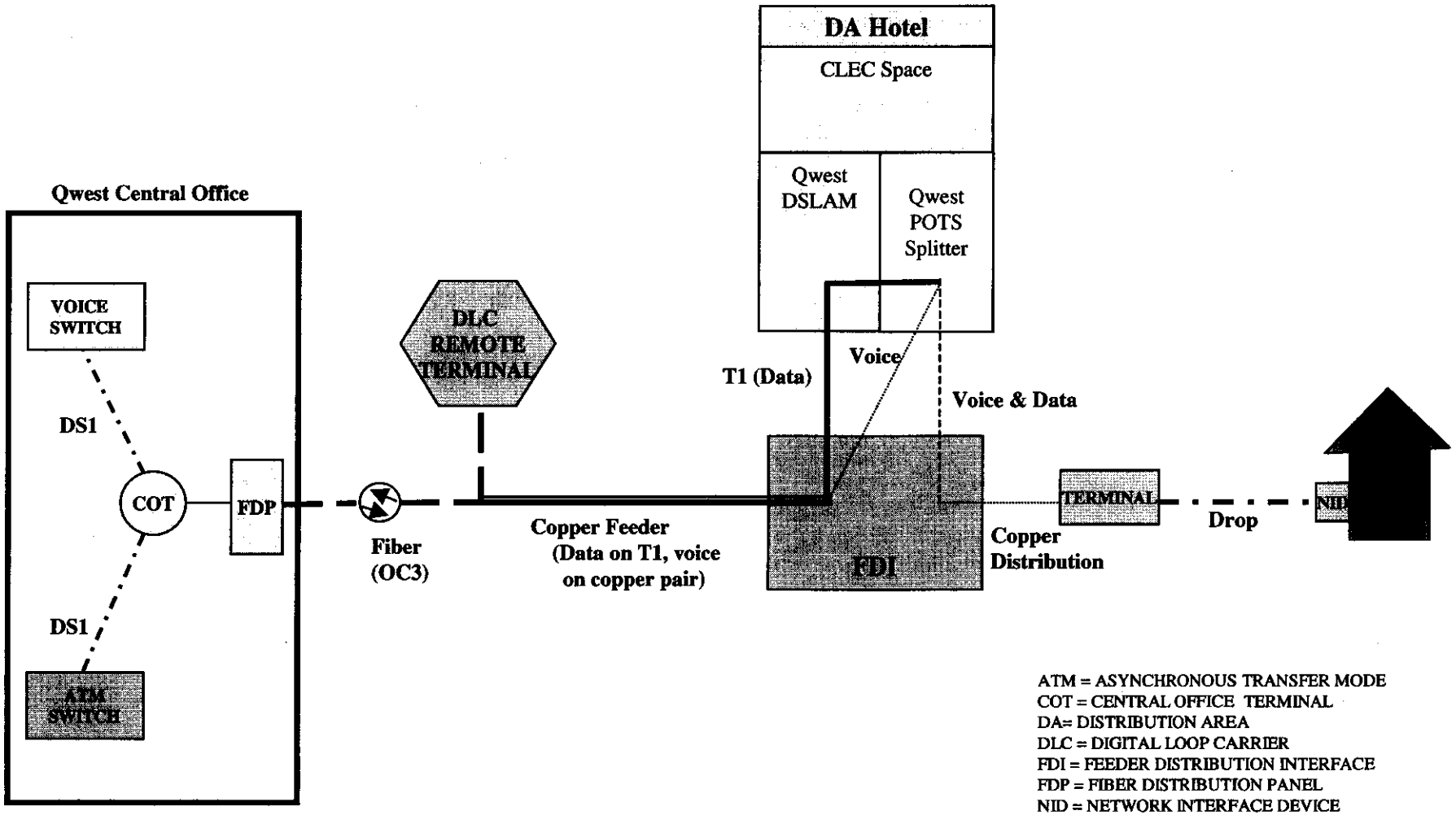
[7] FCC, Common Carrier Bureau, *Trends in Telephone Service*, Table 8.2, Telephone Loops of Incumbent Local Exchange Carriers by State, (May 22, 2002). These appear to be switched access lines, rather than switched plus special access lines.

also obtained original RBOC study area switched access lines for 2000 to arrive at a consistent ratio of RBOC to total ILEC switched access lines in each state.[8] Since we relied on different sources for the data, there were some instances where the ratio exceeded one (these were states where Verizon is the only ILEC). We set those ratios equal to one.

These data are available to any interested party from SPR's web site: http://www.spri.com.

[8] FCC, *ARMIS Database, 43-08, Table II: Switched Access Lines in Service by Technology.*

REMOTE DIGITAL SUBSCRIBER LINE ARCHITECTURE



ATM = ASYNCHRONOUS TRANSFER MODE
COT = CENTRAL OFFICE TERMINAL
DA= DISTRIBUTION AREA
DLC = DIGITAL LOOP CARRIER
FDI = FEEDER DISTRIBUTION INTERFACE
FDP = FIBER DISTRIBUTION PANEL
NID = NETWORK INTERFACE DEVICE